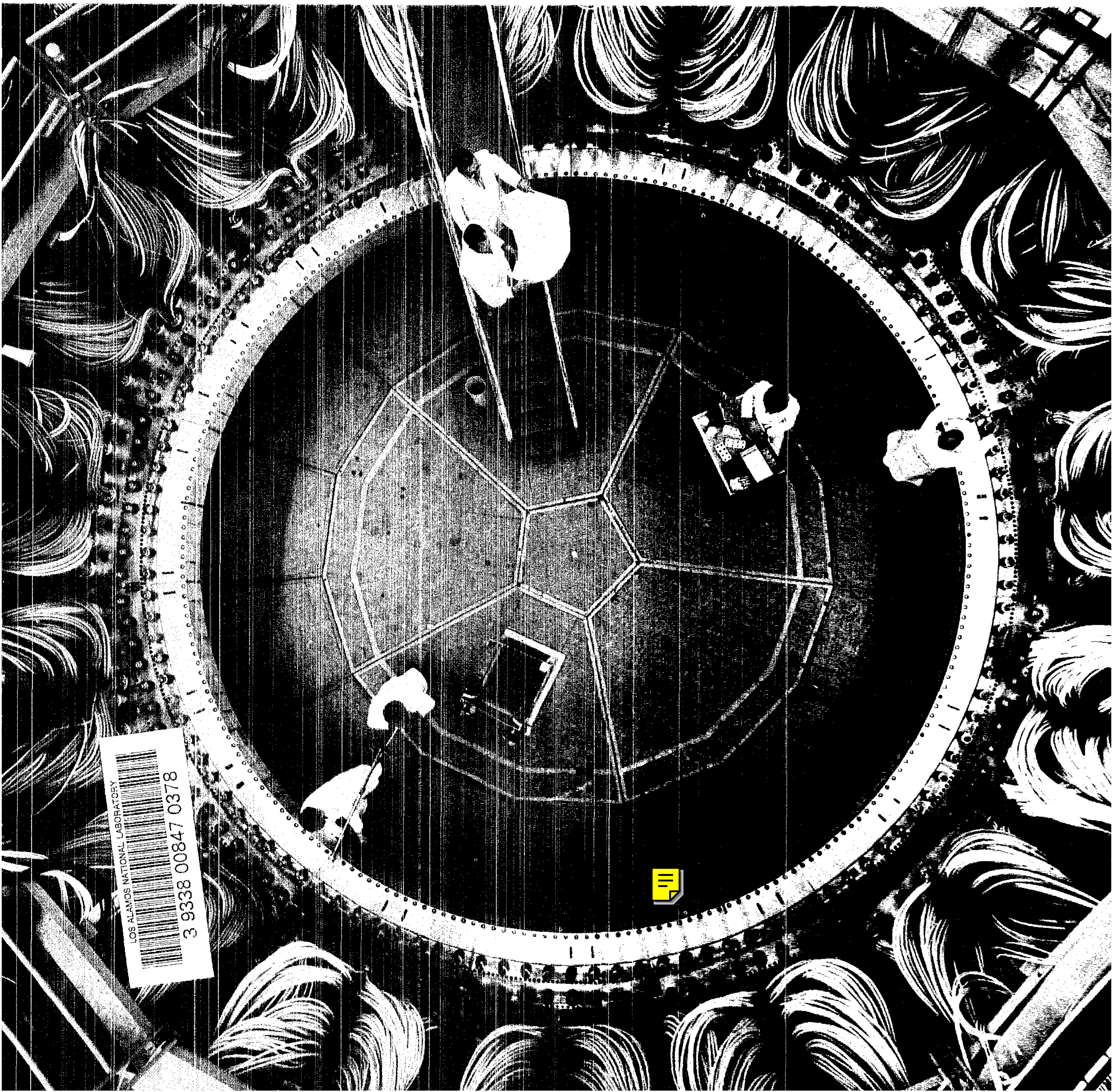
THE ATOM

Los Alamos Scientific Laboratory March-April 1974

TORUS COMPLETE!



Volume 11, Number 2
March-April 1974

THE ATOM

Published bimonthly by the University of California, Los Alamos Scientific Laboratory, Office of Public Information, TA-3, West Jemez Road, Los Alamos, New Mexico 87544. Address mail to P.O. Box 1663, Los Alamos, New Mexico 87544. Second Class Postage Paid at Los Alamos, N.M.

CONTENTS:

Editor: Jack Nelson

Photography: Bill Jack Rodgers, Henry Ortega, "Mitzi" Ulibarri, Wayne Hanson

Office: D-442-B Administration Building. Telephone: 667-6102. Printed by the University of New Mexico Printing Plant, Albuquerque.

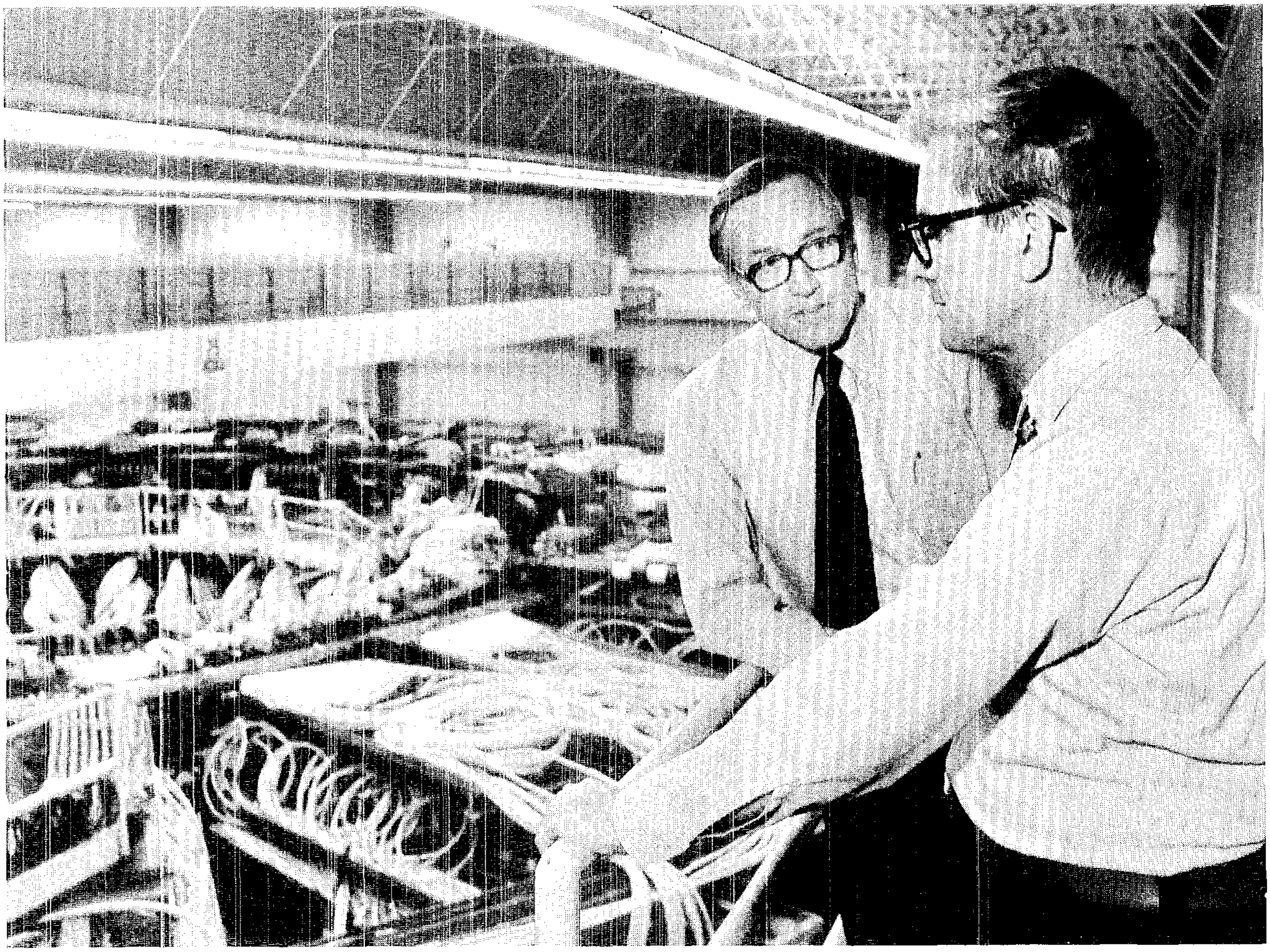
Los Alamos Scientific Laboratory, an equal opportunity employer, is operated by the University of California for the United States Atomic Energy Commission.

COVER

A moment long awaited by the Los Alamos Scientific Laboratory—and by the Atomic Energy Commission and segments of the scientific-industrial community with a stake in energy sources of the future—arrived last month when Scyllac's torus was at last complete.

How Scyllac has "come full circle" and what may lie ahead in Controlled Thermonuclear Research is described in the article beginning on Page 1.

There to record the moment was Bill Jack Rodgers, ISD-7. This more-than routine photo required more than routine preparation. Group CTR-3 hung a scaffold from the ceiling, onto which Rodgers climbed from the Scyllac building's overhead crane. There, lashed securely by a safety strap, Rodgers literally swung from the rafters to give *The Atom* readers an unusual perspective of Scyllac—and one which is not likely to be repeated soon.



Fred Ribe, CTR-Division leader, and George Sawyer, alternate division leader, look over sprawling Scyllac installation—and wonder what's ahead in Controlled Thermonuclear Research now that the torus is complete.

SCYLLAC: closing the gap

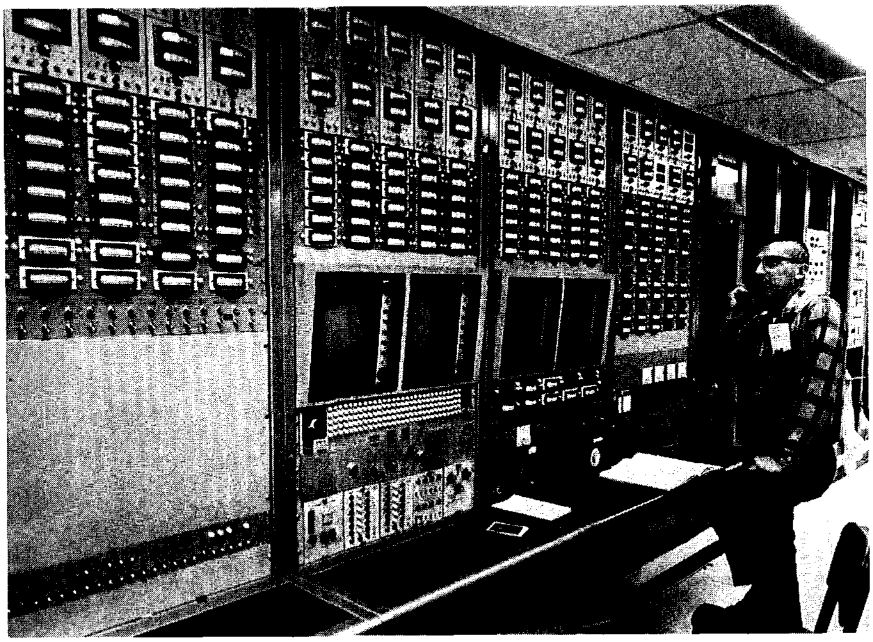
Friday, March 22, was a milestone day—of which there are so many—at the Los Alamos Scientific Laboratory.

And like most LASL milestone days, this one came and went without fanfare.

This was the day when Scyllac's toroidal tube was completed. The circle was closed when men of Groups CTR-3 and CTR-4 bolted coils for the last of the torus' 15 sections into place.

These men and their predecessors had worked towards this day for a very long time. From the world's first controlled thermonuclear research in the whimsically named Perhapsatron of 1953 to the present mammoth apparatus filling a building the size of a gymnasium, they had trod a path in time measuring 22 years and marked by many thousands of experiments.

Completing the "doughnut," thus creating a tube without ends from which plasma cannot escape, at last gives CTR-3 the hardware to test what has long been predicted: the full torus should extend thermonuclear burn 5 to 10 times its present duration.



"Bridge deck" of Scyllac was installed in 1971. Warren Quinn, now CTR-3 group leader, posed at the time with the then new equipment.

If theory proves correct, it will be a bright omen for a nation acutely aware of the necessity to develop new energy sources. It will mean that the eventual generation of power in massive amounts, by fuel from the ocean sufficient for millions of years, may be a realistic expectation.

Moments of Truth Ahead

Now suspense will mount as the pace of experimentation quickens. Significant events may follow in months rather than the years of the pre-Scyllac era now ended. By fall, CTR-3 hopes it will have:

—Tuned the massive, computer-monitored apparatus to balance magnetic energies of 10 megajoules with such delicacy that they will align the compressed plasma perfectly along a complex helical axis at pressures on the order of 120 atmospheres (about 1 ton per square inch).

—Conducted as many as 1,000 experimental shots. Groups CTR-3 and CTR-8 will make basic measurements including neutron production (the major source of usable thermonuclear energy), plasma temperature, plasma pressure, and the key measurement of all: the time burning plasma can be contained.

—Extended plasma containment time from 12 microseconds achieved with 1/3 of the open-end toroidal sector during the last 2 years to 50-100 microseconds within the closed chamber.

Achieving these objectives would lead to larger, more advanced Scyllac configurations in the future capable of containing burning plasma for 1/100 second, thereby producing energy equal to the amount required for maintaining the fusion reaction.

Theta-Pinch

In the theta-pinch concept, magnetic forces are employed to compress plasma away from material walls because no known substance can contain plasma heated to temperatures exceeding those within the sun. Magnetic fields are unaffected by heat.

By stripping electron shells from atoms of deuterium (a hydrogen isotope) in the gaseous state, accomplished in the chamber by a relatively mild preliminary magnetic pulse, a plasma of nuclei and free electrons is created. This plasma is then compressed by an extremely strong magnetic field. The abrupt compression generates a temperature of 10-20 million degrees Celsius, precipitating the fusion reaction.

The theta-pinch principle establishes this magnetic field around the chamber at right angles to the axis of the torus. The force created pushes the plasma towards the chamber axis.

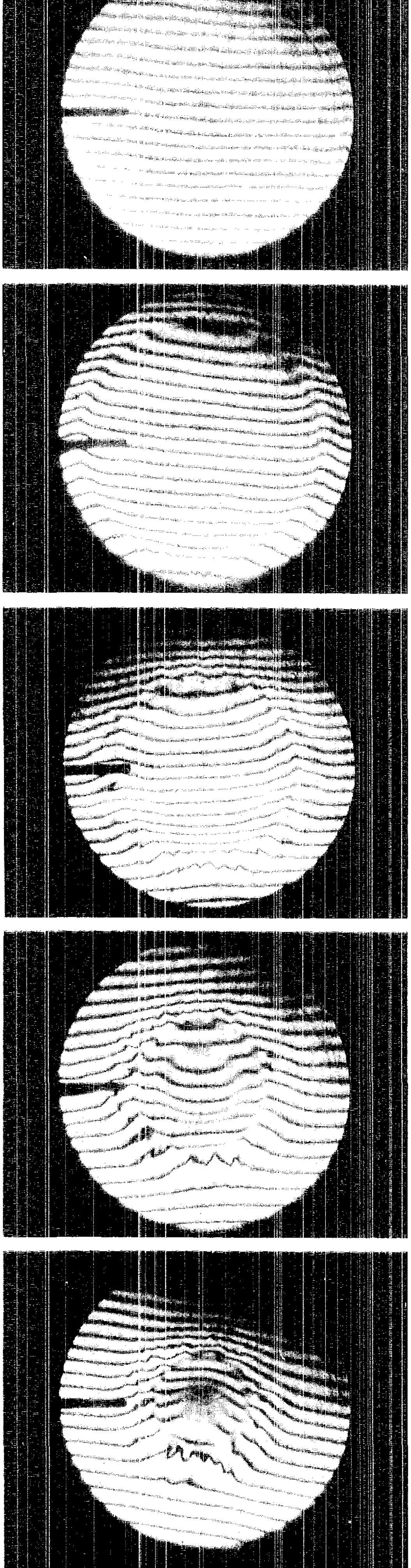
A problem in the theta-pinch process is that when applied in a simple torus, magnetic flux is denser along the shorter inner-chamber circumference than the outer. The plasma tends to drift towards the outer wall because it encounters less pressure from that direction.

Compensating for this is a large part of what recent Scyllac research has been about. Part of the solution is in the present intricate "cork-screw" chamber—a computer-designed geometry of hairpinlike wiggles equalizing the 2 circumferences.

Sculpting this complex shape into custom-machined solid aluminum coils requires a sophisticated milling head made in Italy by only 1 company of its kind. Bob Barnes, shop foreman, Jim Robinson, Wendell "Smitty" Smith, Emmanuel "Mike" Spanos, and Ray Voos have spent 4 months completing this work.

But these ingenious contortions don't solve the problem entirely, so CTR-3 and CTR-4 have devised a

continued on page 4



Plasma Imploding

How plasma implodes is shown in this dramatic set of holographic interferograms made last year using Scylla I-B, a linear device 20 centimeters in diameter (about 4 times wider than shown in the reproductions at left). Such interferograms are likely to become things of the past: they are impossible to make in Scyllac's closed toroidal tube.

In the top photo, plasma is undisturbed in the tube (the dark line at left is the tip of a magnetic field probe). In subsequent interferograms, separated in time by intervals less than 1/5 of a millionth of a second, a magnetic field has initiated a shock wave shown by distortion of horizontal lines. In the bottom interferogram, plasma is compressed to a diameter of 3.8 cm.

Plasma then enters a state of relative equilibrium for a brief interval. Continued magnetic force (or, as proposed for future experiments, a second magnetic jolt from a separate group of capacitors) then initiates fusion.

feedback system to push the pinched plasma back into position as necessary. Sensors report a drift developing and relay this warning to amplifiers. These in turn deliver a compensating magnetic jolt—all in 1 millionth of a second.

If all goes with perfection, the violently compressed ions interact, fusing to form helium nuclei and in the process releasing an avalanche of neutrons and large amounts of energy.

Out of the Forest

Scyllac is a major experiment in the Atomic Energy Commission's Controlled Thermonuclear Research (CTR) program, until recently called Project Sherwood.

Following some early theorizing and research by Edward Teller, Jim Tuck (former LASL P-Division associate leader, now retired), and others, and prompted by reports of controlled thermonuclear research about to start in other countries, Admiral Lewis Strauss, then AEC chairman, asked a number of scientists in 1953 to advise him of the feasibility of controlled thermonuclear fusion.

Told that prospects were promising, Strauss determined to launch a program at once.

Normally, major programs such as this require a year or more for planning and funding. Strauss bypassed this with a bit of legitimate banditry.

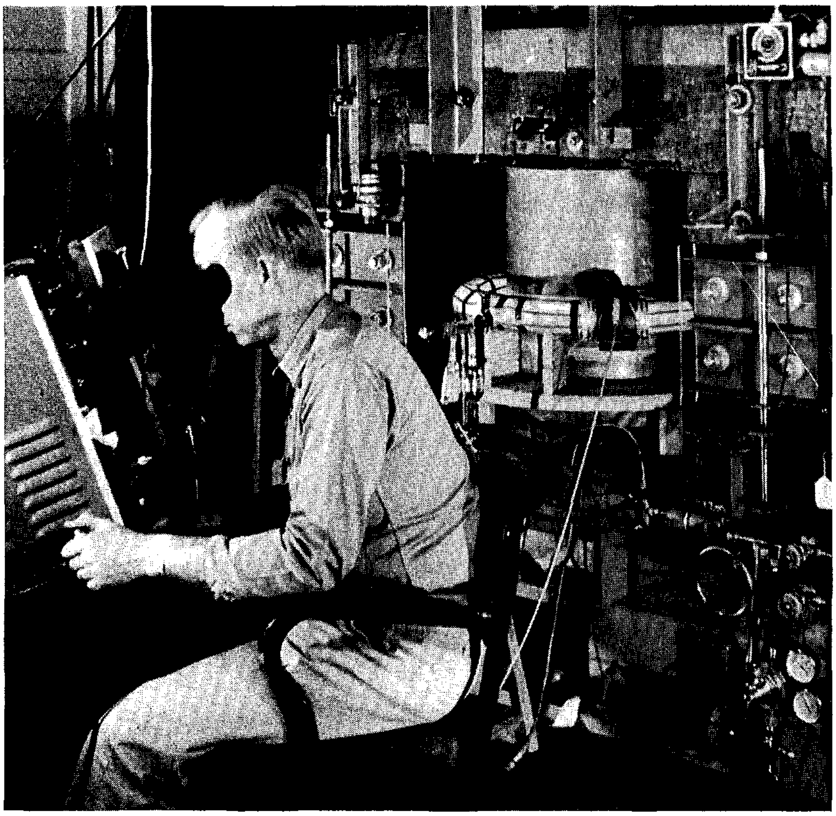
Finding a contract at the Massachusetts Institute of Technology with an underrun, Strauss, like Robin Hood, took from the "rich" to give to the "poor"—in this case, LASL's controlled thermonuclear research program. The then-secret project was named Sherwood—an obvious allusion to the Merry Men's habitat.

Following inconclusive, but nonetheless encouraging, experiments in the Perhapsatron of 1953, Scylla I was built. The name, taken from Greek mythology, is that of a 6-headed, 12-footed monster which dwelt in the Straits of Messina across from a whirlpool and had a voracious appetite for sailors. The name is associated with a particularly difficult passage, no doubt the reason the name was chosen for the theta-pinch program.

Scylla I was a linear device—relatively easy and cheap to build, and while its straight tube permitted escape of the pinched plasma from the ends, it allowed much experimentation. It was in Scylla I (subsequently donated to the

Robert Barnes and Wendell Smith, both SD-5, check freshly machined aluminum coil. Note curve of chamber. Coils with configurations like this give chamber its "corkscrew" shape.

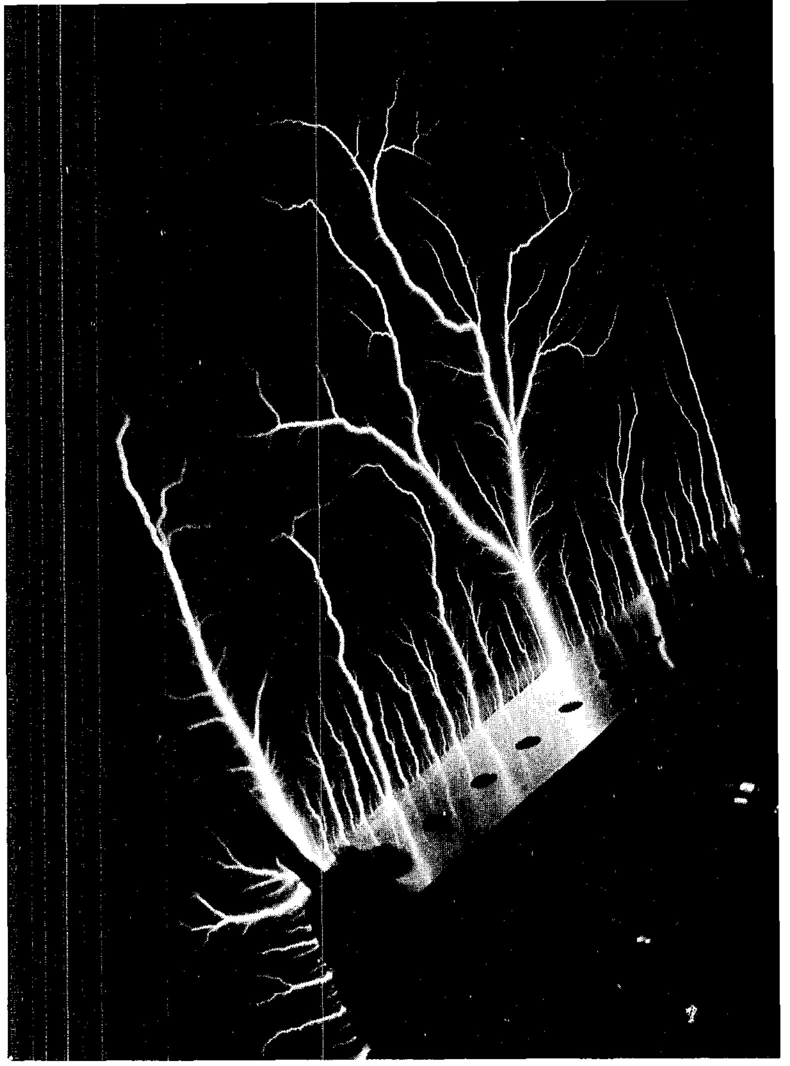
Granddaddy of all CTR research devices is the Perhapsatron. This earliest known photo (1953) shows Emory Stovall, CTR-6, in foreground. Device was in long-since demolished U-Building, vicinity of Los Alamos Inn.



Smithsonian Institution) that the world's first verified controlled thermonuclear reaction was achieved in 1958.

Other Scyllas followed, each representing advances in the state of the art. In 1970, "c" (for closed) was added to the Scylla name as the first curved, but still open-ended, chamber was built in the then recently completed Scyllac building. Experiments were conducted both in this small precursor of the present Scyllac and in a straight tube device.

By early 1973, these devices had served their purposes and were dismantled. Components from both were re-assembled into a larger curved, but still open-ended 120° toroidal section in which experiments were conducted from June through November 1973. At that time, the addition of more coils to complete the circle began. Now, with all 15 segments in place, creating a closed torus 25 meters in circumference, a major assault on the time barrier begins.



Eerie "electric trees" seemingly grow from a metal landscape in this 1969 photo taken of a test of Scyllac prototype coil. A 55,000-volt discharge which flowed over a mylar sheet invisible in photo created the effect.

Power Plant of the Future

For more than a year, Keith Thomassen, Bob Krakowski, and others at CTR-7 have drawn various schemes showing how a fusion power plant of the future might be built around Scyllac-type "innards."

A number of systems would be linked to the torus, creating in effect a giant pulsating engine operating on a cycle somewhat analagous to that of a diesel.

Deuterium gas would be pumped through a vacuum system into the toroidal cylinder.

Electricity, generated in the previous cycle and stored not in the bulky capacitors of today but in a far more efficient cryogenic Magnetic Energy Transfer and Storage System (under development by Groups Q-26 and CTR-7), would be delivered to coils surrounding the chamber, creating the magnetic field compressing the plasma.

Energy from the detonation would be absorbed by a molten lithium blanket surrounding the torus. The flowing lithium would transfer heat to heat exchangers, which in turn would produce steam for turbo-generators. (In more advanced schemes, heat would be transformed directly into electricity.)

Valves would open to exhaust the spent gas, and a new cycle would begin: injection, compression-ignition, power, exhaust. Every 3-10 seconds (more frequently if a cooling system and faster exhaust system were added), the great engine would thus throb.

About 48 per cent of the thermal energy would be converted to electrical output after retaining a portion in the plant to power repetitions of the cycle. In addition, the exhaust would be recycled to recover unburned deuterium (for additional fuel) and helium which would become available for commercial purposes. Lithium would be processed to yield tritium, a man-made isotope which more readily ignites in thermonuclear burn.

The net power output, assuming a torus 14 times the diameter of that of the present Scyllac, would be 1,200 megawatts. Just 300 such plants could provide all the present electrical power needs of the nation.

A virtually endless supply of deuterium, which exists 1 part in 6,700 in water, would be "mined" and "smelted" by plants by the side of the sea. The energy in 1 liter of seawater equals that of 300 liters of gasoline.

Lithium, useful for breeding tritium, does not appear to be in so abundant supply. But by the time thermonuclear plants are built and operating, most scientists believe that by then it will be possible to dispense with lithium entirely.

A Lifetime of CTR

This is the vision of the men of CTR-Division, under the direction of Fred Ribe, who have dedicated a major portion of their professional lives to controlled thermonuclear research.

Some, like George Sawyer, alternate CTR-Division leader, Warren Quinn, CTR-3 group leader, Emory Stovall and Jim Phillips, both CTR-6, and Louis Burkhardt, CTR-2, have been associated with the program since the '50's.

The day when the first controlled thermonuclear power plant goes on line may be 20 or more years away. But in the context of an energy source that may serve man for thousands of years, and in relation to the time these men have already invested, that doesn't seem like such a long wait at that.

New CTR Division Formed

"Because of the increased emphasis on development of fusion power and the great promise which it holds for helping provide the world's energy needs, we believe that LASL's Controlled Thermonuclear Research efforts must now be raised to division status," Harold Agnew, Director, said in announcing the formation of CTR-Division, effective April 1.

Fred Ribe has been named division leader with George Sawyer as alternate division leader.

Ribe has been a staff member at LASL since 1951. In 1963 he received a Guggenheim Fellowship Award which enabled him to study processes in high temperature laboratory plasmas at the Max Planck Institute in Munich, Germany. He is a Fellow of the American Physical Society and a member of the American Nuclear Society. Ribe was associate division leader directing controlled thermonuclear research for Q-Division of the Laboratory.

Sawyer joined LASL in 1950. In 1960 he was a visiting scientist at the Royal Institute of Technology, Stockholm, Sweden. Sawyer is a member of the American Physical Society and was group leader of Q-3 (Theta-Pinch Experiments, Scyllac).

In addition to Ribe and Sawyer, others in the CTR-Division Office will be: Keith Thomassen, associate division leader for technology and advanced development; Maurice Katz, assistant division leader for administration; Harriett Sass, division secretary; and Jean Donham, secretary. James L. Tuck, who for many years directed CTR research at LASL and is now retired, will serve as a consultant to the new CTR-Division.

The group structure will be as follows:

CTR-1 (Plasma Physics Research)—Harry Dreicer, group leader.

CTR-2 (Z-Pinch Experiments)—Don A. Baker, group leader; Joseph Di Marco, alternate group leader.

CTR-3 (Theta-Pinch Experiments, Scyllac)—Warren Quinn, group leader; William Ellis, associate group leader.

CTR-4 (Engineering)—Edwin Kemp, group leader; Robert Dike, associate group leader.

CTR-5 (Plasma Research)—John Marshall, group leader.

CTR-6 (Plasma Theory)—Werner Riesenfeld, group leader; Jeffrey Freidberg, alternate group leader; Clair Nielson, associate group leader.

CTR-7 (Advanced Development and Technology)—Keith Thomassen, group leader; Keith Thomas, alternate group leader.

CTR-8 (Plasma Diagnostics)—Franz Jahoda, group leader; Peter Forman, associate group leader.

The first 7 groups previously existed as such in Q-Division and have generally been transferred intact from Q-Division to CTR-Division. Group CTR-8 is a newly formed one. The CTR-Division initially will include about 135 people, but this number is expected to increase when additional funding for CTR activities becomes available.

The President's budget for Fiscal Year 1975 proposes an expenditure of nearly $13 million for CTR work at LASL—a 60-per-cent increase over the current year's $8.1 million.

The Atom *records an interview with the Director*

on his 25th anniversary with LASL, anticipating

merely a pleasant stroll down memory lane. Instead

AGNEW SPEAKS OUT

. . . on deterrents . . . on energy . . . on science . . . on jobs . . .

on strangulation by red tape and other matters of concern.

(After graduation from the University of Denver, Harold M. Agnew worked with Enrico Fermi at the University of Chicago in achieving the world's first fission reaction, then came to Los Alamos in 1943 to work on the Manhattan Project. Except for absences to earn his doctorate in physics and to serve as scientific advisor to the Supreme Allied Command of NATO, he has been here since. Agnew was Weapons Physics Division leader when he was named Laboratory Director in 1970.)

You participated in achieving the world's first fission reaction before coming to Los Alamos. Did you and your colleagues foresee where this would lead?

I certainly didn't anticipate all the things that were going to happen. Perhaps we thought that nuclear power would come into being a lot faster than it has. We certainly hadn't anticipated some of the furor that has grown up with regard to safety and sitings of these plants. I had always thought of the atom as being a good thing—still do, I guess.

Among the illustrious scientists of those days, to whom did you feel closest?

I was a personal friend of Enrico Fermi and I was a graduate student of his. My wife and I lived with him—as sort of butler and housemaid, you might say—for half a year while we were trying to find housing. He was a marvelous person and had such a fantastic intellect. We still keep quite close to Mrs. Fermi. When I go through Chicago, which is almost once a week, I always try to talk with her on the phone.

Would you compare conditions of 30 years ago to those at LASL today?

When I first came, we were just building, everything was booming. The people were essentially all under 30, housing conditions by our standards today were very, very bad. But even with the mud and all the trials and tribulations, I think, in a way, it was more fun than today. It was just very exciting, you knew what you were doing, and, of course, there were no money problems as far as the Lab was concerned. As far as Washington was concerned, they were there to really help get the job done, not to question continually why you're doing what you're doing.

I think that the competence in the Laboratory is in no way diminished. But the urgency in the context of a full-scale, two-front world war, where you're worrying about the other fellow doing the same thing and doing it first, is quite different.

". . . the military position of the country is experiencing a bad situation."

Have there been changes in defense and deterrents?

It's a much more difficult problem. As a result of the fiasco of the Vietnam War, the military position of the country is experiencing a bad situation. The volunteer army is not going very well, so the weapons work has continuing problems. Some of us at the Los Alamos Scientific Laboratory have been looking at the possibility of really restructuring the whole nuclear stockpile and affecting tremendous savings in material, in manpower. It's a rather bold type of endeavor and would rock a lot of boats.

I don't know whether it will ever come about, but one could do a tremendous reordering and restructuring of the stockpile, which in part could be mined of fissile materials and make a tremendous contribution toward alleviating the energy shortage in the next 5-10 years.

Are your views similar to those of Defense Secretary Schlesinger's?

I don't know. I think he is having to face up to a bunch of problems that he has inherited and I believe some of his questions, namely, do we really have a deterrent in the eyes of our potential enemies, are questions which I feel have been neglected for quite a number of years. He's addressing those problems. I certainly don't argue with his approach. How successful he'll be with the Congress, we'll just have to wait and see.

It took only 2 years to produce the atomic bomb. Why must we wait 20 or more years for practical fusion power?

The difficulty with controlled fusion is today no one knows how to do it.

Now, there is a way to conduct fusion which we have demonstrated, and that is to build hydrogen bombs where we can indeed burn hydrogen fuels very efficiently. Some of the people in the Laboratory, and I certainly support their efforts, are saying, why shouldn't we spend a little bit of money trying to find out if there is some way we can utilize the energy that we can make in hydrogen bombs in the production of energy for peaceful uses. It's a different approach to the fusion program.

I think some of the temperature problems and materials problems that we're going to have to face in the CTR program will mean that we will not experience in this century, in my opinion, any appreciable number of thermonuclear reaction power plants unless there's a breakthrough in the immediate future.

Would a crash program speed things up?

I don't think so. Oh, you might go a little faster. At least you'd find out sooner that you couldn't do certain things and certain demonstration feasibility plants could be built which would highlight future problems sooner.

But there's an aspect in the fusion program that hasn't been worked on long, and that's laser-induced thermonuclear reactions. And it might well be that this might leapfrog the magnetic confinement schemes. This is clearly a subject of intensive debate between the proponents of the 2 schools of thought. The laser work has only really been in being 5 years at most, whereas the other has been in being over 20 years. Our laser program has tremendous potential not only in fusion but in separating isotopes, which is a program we're working very vigorously on. I think this can have some rather far-reaching impacts in our energy future and these impacts will take place before we see fusion.

What is the major challenge at LASL today?

If you had asked me a year ago, I'd say I was worried about funding. Now, I think that is not our major problem. Our major problem now is to accomplish the goals of the many new programs we're involved in, particularly in energy. I think that our work in geothermal energy and power transmission, for example, is extremely important.

I think our problem today is really getting the staff that we're going to need to accomplish these programs in an arena where others are competing for very good people on a very short time scale.

Are we getting these people?

I think there are always problems in recruiting the very best of talent, even when jobs are very scarce. The top-flight people at all the universities have no problems getting jobs, so one competes for these people. And I think we do very well.

Do graduating scientists today have fewer or more opportunities than when you started out?

Oh, I think the opportunities are pretty much what one makes of them. I think there are cycles depending upon the general economic conditions, but there is a tremendous potential now because there has been a decrease in the number of scientists and engineers coming out of universities in the past 5 or so years. So, I think there is going to be a tremendous market for technology, not only in this country, but in South and Central America, in the next decade.

"Oh, I think the opportunities are pretty much what one makes of them."

Along this line, one of our problems is that young people today want to look at their future a little more than perhaps we did some 30 years ago. We want to assure them the chance for advancement. We have a lot of people in the upper echelons that perhaps will be or should be retiring in the not too distant future, so there will be opportunities for people to get ahead. We've instituted a program so that the group leaders don't stay in their jobs for more than 10 years. I think it's good for them to move aside, and it's clearly good for the young people to move up. I think somehow we've got to work out the same sort of arrangement with regard to division leaders and at the same time not penalize any of these individuals, especially financially, for stepping aside.

Has the energy crisis caused any shifts of emphasis in science?

Well, I think the only worry that one might have, and it's a real worry, is that there may be too much of an emphasis on applied science and not enough on basic research or pure science, which sort of says, don't ask me what it's going to do for me today, but it's the technological base I'm going to need in order to achieve practical accomplishments in the future.

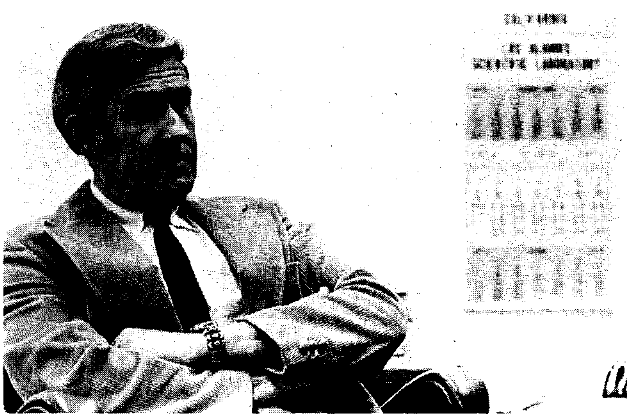
You can see this shifting in the various government agencies that support research. I think it has been perhaps long overdue that people haven't put more emphasis on applied research, but at the same time, one must continue to maintain very strong and vigorous basic research.

In our Lab, unfortunately, one of the things that has been going down, down each year has been our basic research. It was very difficult to maintain in the past years because the total budget had gone down. Now, with the reverse, we are struggling very hard to see if we can get money—you might say siphoning a little bit off the top—to support more adequately our basic research programs.

"Clearly, if there is this island of stability in very heavy elements, we will be most interested in it. . . ."

Where is science heading?

I believe that some of the large gains are probably going to be more in the biological sciences rather than the physical sciences, although there are some very clear examples of phenomenology in astrophysics, black holes and such, that could lead to some extremely interesting fundamental findings. And I think some of the new accelerators—the accelerator at Batavia, the national accelerator laboratory, and our own meson facility—could bring about really new concepts in the study and understanding of matter and the universe.



"I think some of the new accelerators . . . could bring about really new concepts . . . of matter and the universe."

How about low-energy experiments with heavy ions?

We'll just have to see what's going to happen there, and depending on what happens, the country may decide to build a heavy-ion accelerator. Clearly, if there is this island of stability in very heavy elements, we will be most interested in it, not only for purely scientific reasons, but these materials could have some very interesting properties relevant to national defense.

Has the state of the economy affected LASL?

You could say that for the first time in a long time, it looks like we'll have an ample amount of housing. But if we hire as many people as we expect, we'll probably have a housing crunch in another year.

And if you talk with Van Gemert, Supply and Property, he'll tell you what used to take 2 months now takes maybe 6 months. People don't know when they'll be able to deliver and don't know what the price is going to be when they do. This escalation is going to present tremendous problems for us.

When we went in for our new DP site, our contractor costed out a refinery for Shell at around $220 million. That refinery is now costing out at over $480 million—and this is in just 2½ years.

I think we were extremely fortunate in getting LAMPF when we did. We hit it just right. People were eager for the work, eager to bid. Now, it would cost more than twice as much and take twice as long.

Everything is just getting out of hand. We don't know what's going to happen on some of our construction projects that are in the planning phase or that have just been started.

How do you feel personally about moving out of the lab and behind a desk?

Oh, sometimes I miss being able to actually do something, which you can do in the laboratory as an experimentalist rather than just write papers or argue about papers that other people write.

Or respond to a bunch of seemingly stupid teletypes or requests day after day.

You're getting more of these?

The whole laboratory is operating under more and more restrictions, more and more forms to fill out, more and more surveys. As far as I can see, the people in the Washington area, in the AEC hierarchy, even in part in the University, are more concerned with our filling out forms or complying with certain regulations than they are with the technical work we are attempting to do.

It seems as though there's a whole gaggle of bureaucracy building up who deem it necessary, in order to justify their existence, I guess, that they have us surveyed, have us comply, have us interact with them primarily to satisfy their own rationale for existing.

". . . I don't think there'd be any loss whatsoever as a result of all those people just staying home and enjoying themselves."

If it weren't for the assistance of lots of people, like Raemer Schreiber, Duncan MacDougall, Dick Taschek, and the division leaders in this era of bureaucracy, the paper work would be intolerable.

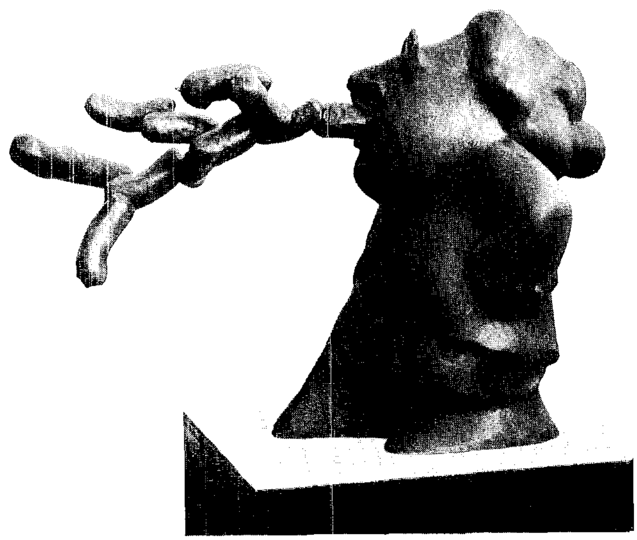
And we're having to hire more people to take care of these demands, people whose sole duties are to attempt to make those other people happy. If someone doesn't stop this nonsense, all we'll be doing is sending letters back and forth between ourselves, the University, the Atomic Energy Commission, and other governmental agencies.

I just think the country would be much better off if a large number of those people in Washington would just go home. I don't want them laid off. But I think we'd be better off if they were just told to stay home and receive their checks in the mail, and just don't do anything. We would do much more work for the country, and I don't think there'd be any loss whatsoever as a result of all those people just staying home and enjoying themselves. I wouldn't begrudge their nonactivity one bit. The overall benefits to the country would, in my opinion, be enormous.

This singular sculpture sits in Agnew's office. Links of bologna are rather grotesquely being disgorged from a gargoylelike creature's mouth. Surely no other laboratory director's office anywhere has a piece like it.

Aside from expressing more eloquently than words Agnew's personal distaste for baloney, it reveals another aspect of Agnew's personality: never to take the world's or one's own foibles so seriously that one cannot laugh.

A sense of humor in high places may be the ultimate weapon in saving the world from itself.



SCIENCE SPECTRUM

If your group has achieved a scientific advance, acquired new equipment, or developed a new technique, we'd like to know about it. Phone The Atom at 6101 for possible inclusion in future Science Spectrum sections.

Globs of Gold

You can do a lot with gold. Group E-2's Hybrid Circuit Section, which deals in the lilliputian world of miniaturized circuits, uses gossamer 0.5 mil gold wire, among other things, to bond from transistor chips to substrates.

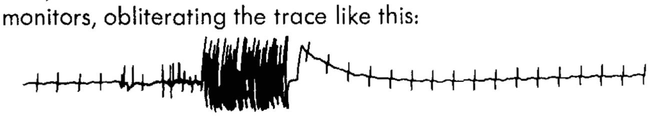
But the section has had problems. The bonding machine with which until now the gold has been applied did not allow precise pressure adjustment. Consequently, some chips were being cracked internally, causing shorts.

An advanced Thermal Compression Wire Bonder that arrived in March solves the problem. Gold wire feeds through a tiny glass capillary (visible in the photo at right). A quick burst of hydrogen flame severs the wire and forms the tiny piece into a molten glob. Chips can then be bonded by pressure applied with great delicacy.

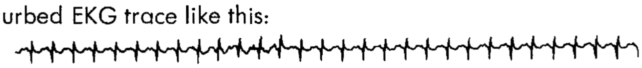
Straight from the Heart

Anesthesiologists can safely ignore a little static occasionally obliterating the EKG (electrocardiogram) traces they monitor during noncritical operations. But when arrhythmia or heart arrest is a possibility, they would much prefer to read the heart's performance at all times.

Easier said than done. When surgeons use an ESU (electrosurgical unit) during open heart surgery, unwanted electrical currents from spark gaps of probes and cauterizing devices flow through tissue and into EKG monitors, obliterating the trace like this:



To eliminate this troublesome "blackout," typically lasting 3-10 seconds, Danny Doss and Bill McCabe, both MP-3, developed a radio-frequency isolation transformer and an improved EKG preamplifier design. These devices screen out electrical noise to allow a virtually undisturbed EKG trace like this:



The devices are used once or twice a week at the Los Alamos Medical Center and have attracted attention within the medical profession.

Swinging Super Spectograph

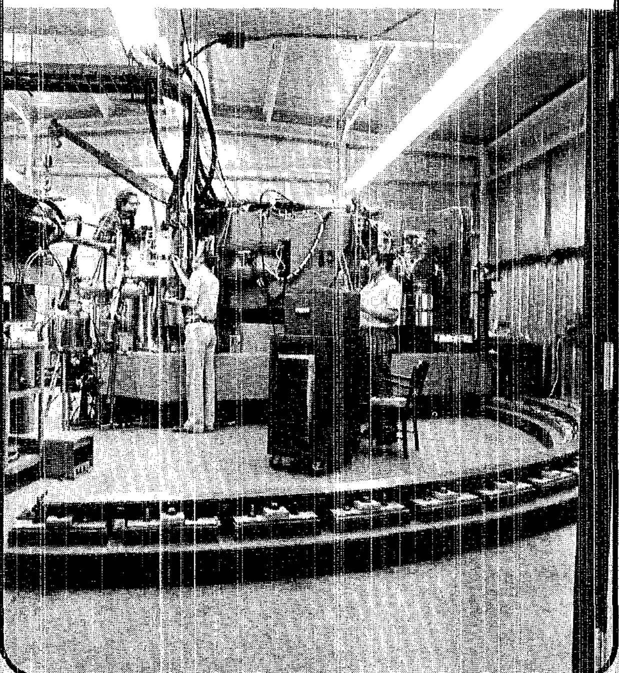
A new, 95,000-kilogram (over 100 tons) assemblage of magnets and a detection chamber that pirouettes on a rail around a stationary target chamber at P-9's Tandem Van de Graaff facility may lead to important findings in light-and heavy-ion nuclear physics.

The Q3D Magnetic Spectrograph System replaces the smaller Elbek Magnetic Spectrograph. The new apparatus increases angular acceptance, and thus the data-taking rate and sensitivity, 40-fold. Spectra resolution is more than doubled.

The spectrograph facilitates current light-ion experiments using beams of deuterons, tritons, and helium ions. And it gives P-9 the hardware to begin a new series of experiments this year with heavy-ion beams of carbon, oxygen, sulfur, and other elements.

A quadrupole and 3 dipole magnets generate a maximum field bending strength of 18,000 gauss. With this field, proton energies up to 155 MeV can be measured. Varying the field strength allows study of many different particles and energies. Rotating the device permits measurements of angular distributions.

Ed Flynn, Nelson Stein, and Joe Sherman, all P-9, are conducting experiments. Stuart Orbesen and Dick Woods, both P-9, handle technical aspects of the mammoth spectrograph, the installation of which began a year ago and was completed late in February.



Getting Potted

Getting potted is not recommended for humans, but it's a fine way to insulate magnets exposed to intense radiation, such as generated at the proton target of LAMPF's Stopped Muon Channel.

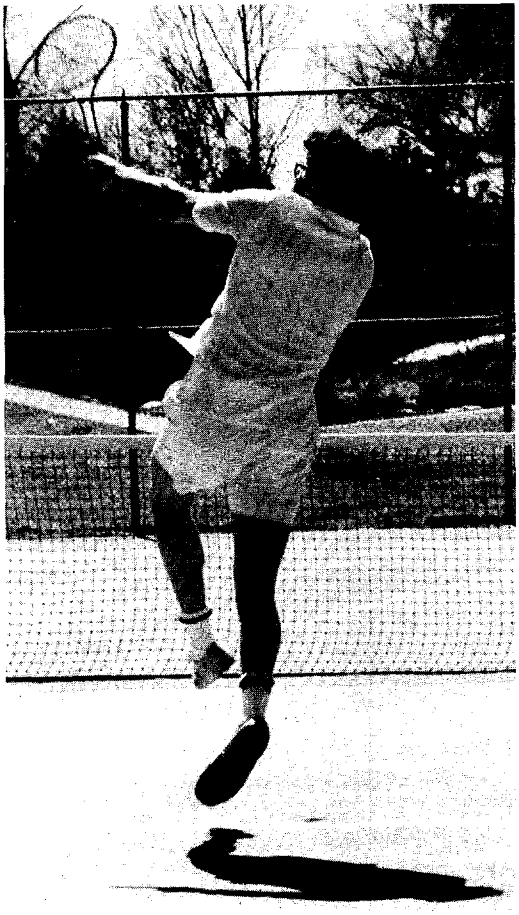
The potting medium, surprisingly, is cement. Casting it about the 4 copper-wound quadrupole and bending magnet coils, which are first wrapped in glass tape, is like pouring a cement sidewalk around rebar.

The coils are placed in a mold and cement is poured around them. The mold is vibrated to assure even distribution. The finished products are the cement-encased coils, shown in the photo above, now installed on the magnets, where they shape meson beams while subjected to constant, heavy radiation.

Smaller beam-line magnets had previously been insulated by the same technique. This represents the first application to large magnets.

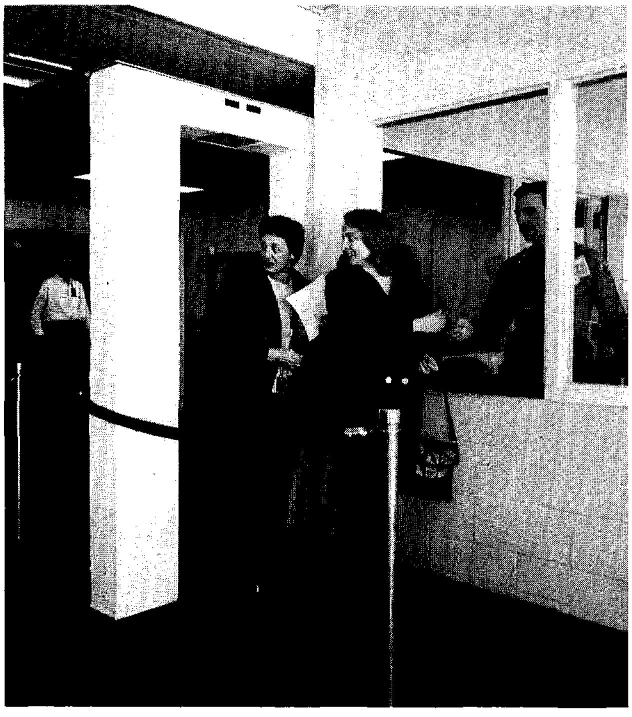
Earlier tests had confirmed resistivity and mechanical integrity of the cement, specially formulated by Group CMB-6. The coil may short to ground as a result of water saturation, but regains its full insulation properties upon dry-out.

The concept was developed by the late Jerry Rosenthal, CMB-6, and Herb Vogel, MP-7 (in photo). Among its advantages: simplicity, reliability, and substantial savings in fabrication and materials.



A spring for a high one by Barry Newberger, T-6, signals the arrival of spring at Los Alamos. Increasing numbers of LASL employees are frequenting nearby tennis courts for a few quick sets during the lunch period. Other signs of spring: more joggers, cyclists, and employees enjoying their lunch in the springtime sun.

Newsmen representing 8 organizations attend a briefing by Charles Browne, J-Division leader (standing), at the Nevada Test Site prior to the Feb. 27 Latir test of a nuclear device in the AEC-defined 20-200 kiloton range. Some observers later viewed the subsidence crater after monitoring the test on closed-circuit TV in the CP-1 readiness briefing room. This was the first underground test at the Nevada Test Site open to newsmen and observers in 2½ years.



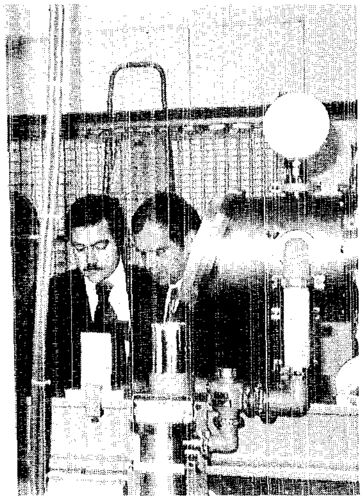
Through these portals pass the most puzzled people in Los Alamos—like Sally Rhodes, ENG-2, and Jean Capelli, ENG-3, checking out by Security Inspector Marvin Click. Guesses range from a metal detector to the unprintable. Correct answer: the device is a doorway monitor to detect the removal of special nuclear material. It is installed at the Administration Building main entrance to test the monitor itself. By installing the monitor in an area of negligible radioactive source movement, Group A-2, which developed the device, is determining any tendencies towards "false alarms" due to statistical fluctuations or extraneous background. Tests may be concluded this month.

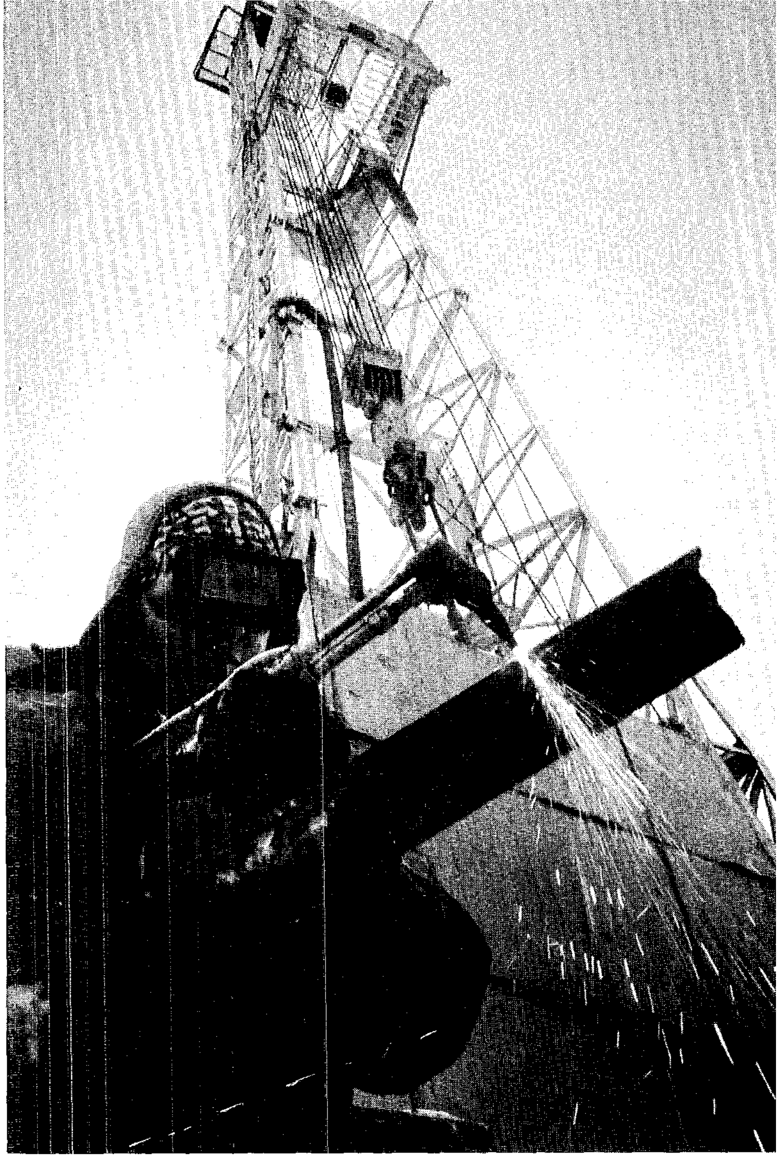
Photo Shorts

"Greetings from Deutschland— I'm here at the Max-Planck-Institut fur Plasmaphysik on 6 months leave of absence working on a kilojoule iodine laser system and here's a picture of the gentlemen I work with. From left to right, me, Dr. Kristian Hohla, Dr. Karl Kompa, Dr. Gunter Brederlow, and the kilojoule-nanosecond iodine laser head.

"Must rest up now for the Fasching (carnival) party tomorrow. See you in April."

Charlie Fenstermacher
(L-1 Group Leader)





The tower's up, the drill is heading down at Group Q-22's Fenton Hill Geothermal Test Site. Men of Calvert Western Drilling Company, Tulsa, Oklahoma, such as the welder above, have drilled to a depth of 720 meters, expect to reach Q-22's goal of 1,400 meters this month. Men are on 24-hour, 7-day-a-week shifts.

short subjects

LASL's first J. Robert Oppenheimer Research Fellowship has been awarded to **David K. Campbell,** presently a member of the Institute for Advanced Study, Princeton, N.J. Campbell will work in T-Division.

The Fellowship was established to bring outstanding recent recipients of doctoral degrees to LASL for special postdoctoral research.

H. Jack Blackwell, manager of the Atomic Energy Commission's Los Alamos Area Office, has been transferred to the Office of the Assistant General Manager for Administration at the Commission's headquarters in Washington, D.C. His successor will be announced later.

Blackwell has been associated with the nuclear weapons program since 1947 and has been manager of the Los Alamos Area Office since 1968.

A LASL team has flown to Latin America for a final series of high altitude environmental tests under the auspices of the Department of Transportation's Climatic Impact Assessment Program (CIAP) and the AEC's Airstream Program. **Paul Guthals, Bill Sedlacek, Phil Moore,** all CNC-11, and **Earl Rutledge,** J-1, will participate in studies of the effects of aircraft engine emissions on the stratosphere and other environmental matters.

Honors: **H. C. Donnelly,** manager, AEC Albuquerque Operations Office, has received the AEC's highest honorary award, the Distinguished Service Award. **Louis Rosen,** MP-Division leader, has been named chairman of the Ad Hoc Committee on Applied Physics of the American Physical Society.

Group Q-23 has begun a new series of subterrene experiments at TA-5, Beta Site. By melting 50 holes in an arch-tunnel pattern, a small excavation 4 meters deep is being made. Tests to melt a 30-meter-deep hole in basalt at a new site in Ancho Canyon will soon begin. Experiments may lead to large scale tunneling by arrays of subterrenes melting simultaneously.

Roy Greiner, Larry Blair, and **Jim Young,** all L-3, have completed experiments conducted jointly at Sandia Laboratories using Sandia's electron beam accelerator to ignite a hydrogen-fluorine mixture very rapidly in a LASL-designed chemical laser tube. Purpose: to show that this approach can yield a large quantity of energy at high chemical and electrical efficiency for possible laser-fusion application. Results: 2,500 joules in 25 nanoseconds yielding a hundred billion watts peak power. Work is continuing at LASL.

Commuter bus service from Santa Fe to Los Alamos has proven popular. Two busses are now making the run. In addition, the busses now accept passengers other than LASL employees. Phone the travel office for details.

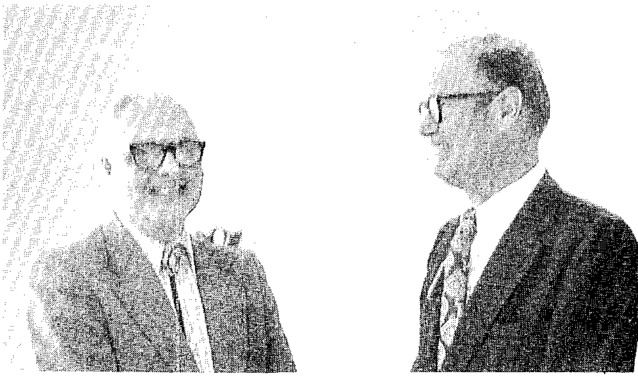
Charles Metz, retired former CMB-1 group leader, died in February. Metz came to Los Alamos in 1944 to serve on the Manhattan Project and, except for an absence to teach at Colorado State University in 1945 and 1946, had been a LASL employee until his retirement in 1972. Metz was a Fellow of the American Institute of Chemists and a member of other professional organizations.

Other deaths: **Robert H. Bates,** AO-4 group leader; **Robert M. Lang,** E-5; **Orba Booth** and **Daniel Reed,** both retired and formerly Supply and Property Department.

Among Our Guests

To review fiscal matters, William McCormick, chief of the energy research and development branch of the energy sciences division of the Office of Management and Budget visited LASL in March. Left to right, Don Kerr, assistant for research, McCormick, and Richard Taschek, associate director for research.

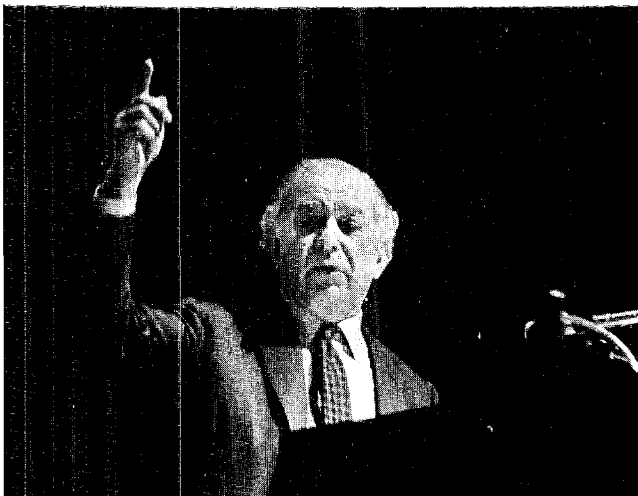
To speak to members of the Northern New Mexico Chapter of the National Property Management Association, whose membership includes many LASL employees, Richard Gafarian, left, deputy director, industrial material management, USAF Contracts Management Division, Kirtland Air Force Base, visited Los Alamos in March. At left is Dwight Clayton, SP-2, local chapter president.



To participate in briefings and tours, Deputy Secretary of Defense William P. Clements, Jr., (left) visited LASL in February. Here he watches a "live" subterrene demonstration with John Rowley, Q-23 group leader, (center) and Malcolm R. Currie, director, defense research and engineering, the Department of Defense.

To discuss research and educational problems of common interest, the Navajo Community College Board of Regents met March 5-6 in Los Alamos with LASL representatives. Here Fred Young, L-4, addresses group.

To speak on "Pride and Prejudice in Science" at a colloquium, Sir Solly Zuckerman visited LASL in February. An anatomist who gained recognition through studies of primate behavior, Lord Zuckerman assisted the British government during World War II, became its chief scientific advisor during the '60's, and retired in 1971.



Pins Given for 10 & 15 Years Service

Service pins were recently awarded to over 500 employees. In this issue, *The Atom* salutes those receiving awards for 10 and 15 years of service. In the previous issue, *The Atom* named those honored for 20 25 and 30 years of service.

15 Years

Adams, Warren, H-7
Archuleta, Harold, CMB-11
Arnold, Charlie, CMB-11
Atencio, Jose, H-4
Babich, June, SP-4
Bacon, Barbara, C-4
Baldock, Della, Q-DO
Bankston, Charles, Q-23
Bazzell, Dewight, WX-3
Berrett, Melvin, ENG-4
Boone, Helen, SP-DO
Borch, Niels, WX-5
Bowman, Allen, CMB-3
Boyer, Robert, SD-1
Buchanan, Tom, SD-4
Bush, Edgar, Jr., MP-8
Bustos, Lois, H-1
Charmatz, Albert, WX-6
Collins, Don, J-3 (NTS)
Crawford, Theodore, J-8
Critchfield, Charles, T-9
Dahlby, Joel, CMB-1
Dickman, Donald, C-3
Dietz, Jack, TD-7
Donaldson, Samuel, J-12
Drake, Glessie, H-4
Ebert, William, ISD-5
Eilers, Donald, J-15
Emery, Charles, CMB-11
Erickson, George, L-1
Farmer, Otis, T-3
Feber, Roy, Jr., CMB-8
Field, William, ADWP-1
Flynn, Edward, P-DOR
Foglesong, Jake, CMB-7
Folkner, Charles, C-DO
Freed, Arthur, ISD-4
Fries, Ralph, L-4
Godfrey, Lois, ISD-4
Gomez, Hilario, CNC-4
Gonzales, Jose, H-1
Green, Kenneth, J-10
Gritzo, Ludwig, TD-7
Groff, Robert, WX-1
Harvey, Raymond, SP-2
Haskins, Jack, SD-5
Hedstrom, James, Q-DOT
Herrera, Edwina, ENG-3
Hidy, Elaine, H-1
Hoak, Lester, L-3
Hupke, Lawrence, Q-23
Hutchinson, Marie, ENG-1
Jeffries, Robert, J-10
Jones, Douglas, SD-5
Jones, Lawrence, CMB-7
Kandarian, Robert, MP-8
Kelly, Robert, WX-3
Kemme, Joseph, Q-25
Kerns, Clifton, WX-3
Lederer, Harold, MP-1
Lindstrom, Ivar, WX-5
Lopez, Abedon, M-6
McConnell, Paul, ENG-DO
McDonald, John, ISD-6
Martinez, Clara, SP-3
Martinez, Julian, ISD-5
Martinez, Lonjino, MP-7
Martinez, Theresa, AO-4
Meadows, George, CMB-1
Melton, George, CMB-11
Merts, Athel, T-4
Miera, Antonio, J-6 (NTS)
Miller, Leston, J-16
Miller, Lonnie, SD-1
Miller, Warner, M-3
Morgan, James, CMB-5
Naffziger, Richard, WX-3
Newton, Eulalia, ISD-5
Oliphant, Thomas, Jr., Q-7
Orlicky, Vincent, WX-3
Orton, Warren, WX-1
Payne, James, P-4
Powell, Anne, AO-2
Price, Barbara, SP-3
Ray, Dwight, M-2
Rhodes, Sally, ENG-2
Rich, Walter, ADWP-2
Richman, Chaim, H-4

Richmond, Chester, H-DO
Richter, John, TD-4
Riggs, Mary, MP-DO
Romero, Fabiola, AO-4
Romero, Jim, SP-4
Romero, Pablo, H-1
Romero, Victor, L-1
Roybal, Edward, WX-3
Salazar, Jose, WX-3
Salgado, Peter, TD-7
Sanchez, Jose, H-1
Showalter, Robert, P-4
Silbert, Myron, P-3
Smith, Gordon, DIR-FMO
Springer, Thomas, E-6
Stoll, Robert, WX-5
Storms, Edmund, CMB-3
Swartz, Blair, C-6
Torrey, Martin, TD-4
Verre, Raymond, CMB-11
Vucenic, Joseph, C-1
Wallace, Terry, CMB-3
Wallis, John, SD-5
Wenzel, Robert, L-3

10 Years

Allen, Danny, ENG-2
Anderson, Barbara, J-10
Andrew, James, CMB-5
Armstrong, Sherman, CMB-6
Barrone, Lawrence, ISD-7
Basinger, Richard, CMB-14
Bergey, James, E-DOR
Blackwell, Marjorie, C-6
Blandford, Ray, Jr., C-4
Bowman, Woodson, Q-2
Bremer, Edwin, ENG-2
Bryant, Richard, SD-5
Bueschel, Fae, PER-1
Burke, Helen, PER-1
Burnett, Betty, ISD-4
Butler, Harold, MP-1
Buzbee, Billy, C-3
Campbell, George, CMB-11
Castine, Peter, CNC-11
Chavez, Mariano, ENG-2
Conant, Donald, CNC-2
Davis, William, CMB-7
Dross, Allen, CMB-11
Dunning, Donald, WX-1
Ellis, Albert, P-3
Ellis, Jimmy, CMB-6
Erkkila, Bruce, P-12
Felton, Shirley, AO-1
Fenstermacher, Marielle, CNC-2
Fritz, Georgia, H-4
Fullbright, Henry, M-1
Fultyn, Robert, H-1
Gardner, Judith, WX-DO
Gibbons, Donald, H-1
Gibson, Theodore, P-9
Gido, Richard, Q-23
Gifford, Duane, C-1
Giger, Audrey, CNC-4
Gonzales, Reynalda, WX-3
Gregg, Charles, H-4
Gregory, Thomas, Jr., M-1
Griggs, James, Q-23
Gutierrez, Rick, WX-3
Hanawalt, George, E-DO
Handy, Larry, E-4
Harbur, Delbert, CMB-11
Harder, Duane, C-DO
Harper, Charles, PER-7
Harris, Robert, MP-1
Hendron, Robert, ENG-7
Hill, Hunter, CMB-5
Hoard, Donald, H-4
Hodgkins, David, MP-10
Hoffman, Betty, CNC-11
Holley, Faye, AO-3
Jameson, Robert, MP-9
Jaramillo, Mary, WX-2
Kasman, Keith, SD-5
Keller, Helen, ISD-6
Kellogg, Martin, MP-1
Ketola, Helen, ISD-4
Killoran, Richard, C-1
Klatt, Calvin, CMB-11
Lapp, Robert, M-5
Lathrop, Kaye, T-1
Leffler, Ira, ENG-4
Lehman, Charles, Jr., CNC-4
Lemons, Wayne, MP-9
Lewis, Harold, Jr., Q-6
Lewis, Paul, Jr., SD-1
Lindahl, John, J-6
Lindsay, James, Q-26
Loddy, Estell, AO-1
Lowry, Neil, Q-3
Lury, Robert, L-2
Lyon, Norman, Jr., SD-1
MacRoberts, Martin, TD-5
Mannon, Thomas, SP-DO
Marshall, Alan, C-4
Martinez, Marcella, T-6
Martinez, Teodoro, Jr., H-7
Mascarenas, Arthur, C-1
Merson, Thomas, ENG-6
Michel, Phyllis, AO-1
Milligan, Donald, WX-3
Millsap, Eddie, E-2
Mitchell, Charles, ISD-6
Mitchell, Joseph, CMB-6
Montoya, Paul, CMB-11
Morris, Wayne, J-6 (NTS)
Mueller, Charles, MP-7
Muffly, Harry, SD-1
Olivas, Raymond, Q-23
O'Neal, Melvin, CMB-7
Ortiz, Romeo, L-2
Owens, Charles, SD-1
Parker, Joseph, MP-1
Pequette, Eldon, J-9
Peterson, Charles, WX-5
Peterson, Rodney, SD-5
Plehn, Richard, WX-3
Plopper, Clifford, MP-1
Puckett, John, ADWP
Randolph, Francis, H-DO
Ratliff, Robert, H-4
Rendon, Steven, WX-3
Richardson, Marcia, WX-3
Roberts, Merle, SD-1
Robertson, Cleo, J-DO
Rodriguez, Eliseo, Jr., SD-5
Romero, Alex, Jr., WX-3
Romero, David, SP-3
Roybal, Leroy, WX-3
Sanchez, Nancy, C-1
Sandmeier, Henry, TD-6
Segar, Frances, CMB-5
Sharp, Ronald, J-7 (NTS)
Shelton, Bethel, WX-7
Smith, Donald, C-1
Stewart, Adelia, ADWP
Stirpe, Dante, TD-7
Taylor, James, Q-26
Taylor, John, M-4
Tech, Earl, P-4
Todd, Billy, WX-6
Trujillo, Faustin, MP-8
Tucker, Syrena, P-12
Turner, David, TD-6
Tyson, Mary, CMB-6
Vander Maat, Paul, TD-2
Vaughan, A. G., L-3
Vigil, John, T-1
Voss, Hans, MP-7
Wallis, Phyllis, MP-1
Ward, Ralph, H-7
Watson, Clayton, ADWP-2
Weiss, Paul, L-1
Westervelt, Alice, TD-2
Wilde, Kenneth, ENG-1
Williams, Elva, M-4
Williams, James, L-5
Wilson, Lynn, PER-1
Wing, Janet, J-15
Winn, Kenneth, L-2

The Iron Dogs of Anaktuvuk Pass

Article and Photos
by
Wayne C. Hanson

(Before joining Los Alamos Scientific Laboratory in June, 1973, as Group H-8 ecology section leader, the author conducted extensive investigations of strontium-90 and cesium-137 fallout in Alaska for Hanford Laboratories from 1959 through 1972. He returned to Alaska in 1973 and will return again this summer to continue this AEC program.

(Much of his research into northern Alaskan ecosystems took place at a remote Eskimo village in the Brooks Range of the Arctic Mountains 240 kilometers south of the Arctic Ocean. This village of 140 habitants is the home of the nunamiut, *or "people of the land," a formerly nomadic Eskimo ethnic group which subsisted principally on inland caribou herds migrating seasonally through Anaktuvuk Pass between lichen grazing grounds.*

(The author's research has been accompanied by a growing comprehension of the life style of a people whose language he spoke and among whom he formed many close friendships. His observations of the radical societal changes wrought virtually overnight by the seemingly beneficial introduction of white man's ways and technology into a primitive subsistence hunting culture comprise valuable scientific spinoff.

(The following excerpt from the author's Ph.D. dissertation at Colorado State University, where he was until recently a faculty member, describes the traumatic series of events that followed the introduction of one of the white man's most recent mechanical innovations into the nunamiut *culture.)*

One of the main expenditures of the modern *nunamiut* is the purchase and maintenance of a snowmobile, which has now almost entirely replaced the dogteam as a source of traction. The first snowmobile appeared in Anaktuvuk Pass during January, 1964, when the white school teacher imported and sold his used machine to 2 brothers.

This innovation of traction appeared at about the same time in other Alaskan Eskimo villages and in Lapland areas of Norway, Sweden and Finland. In all cultures the snowmobile has had wide-ranging and interrelated consequences, and those in the *nunamiut* society have been especially noticeable.

The number of snowmobiles in the village has increased from the single used machine in January, 1964, to a total of 46 machines in August, 1972, of which 24 were operable, 19 were inoperable, and 3 were burned chassis that were visible. In addition, there was 1 larger tracked vehicle and 1 wheeled all-terrain vehicle.

The impressive attrition among the snowmobiles has been due to a combination of extreme cold, sparse snow cover on a rough topography, poor adaptability of construction materials for the hard use the machines receive, and the quality of home repair work of frequent breakdowns. The natural mechanical ability for which the Eskimos have been noted by casual observers seems inadequate to the task of major repairs and several machines have suffered from inquisitive tinkering.

When one considers that the base price for a snowmobile ranged from $700 to $1,000 plus $200 air freight from Fairbanks; that gasoline sold for $2.60 per gallon until 1971, when it was reduced to $1.60 per gallon; that active hunters consumed about 200 gallons per season (October-May); and that the average family income during the period of initial snowmobile acquisition at Anaktuvuk Pass was in the range of $2,000 to $4,000 per year, it is readily apparent that the snowmobile had great economic consequences.

However, the cultural consequences went far beyond the financial aspects.

During the decade following the settlement of Anaktuvuk Pass in 1950-1951, the people underwent gradual acculturation. Varied amounts of subsistence hunting and trapping were carried out by the families by dogsledding during periods of snow cover and dog-packing during summer months. My observations during 1962-1964 suggested a relatively stable period of village life-style.

Dogs were prestigious and received generally good care, although they were occasionally beaten as a function of a "psychological escape valve" for the venting of feelings of frustration. Five years was the effective life of dogs, in the Eskimos' opinion, and most were shot shortly after reaching that age unless the animal was a valuable lead dog or "good puller." The dog was the only means of transportation of caribou carcasses and for hunting by which the continued existence of *nunamiut* society was possible in 1961.

The maintenance of good dog teams required considerable effort to provide hot food and water throughout the winter, particularly after an arduous trip; however, of even greater importance was the preparation of the dogs for a winter of hard work. The better hunters of the village took their teams some distance from the village for periods of 1 or 2 weeks, usually during late August, for the express purpose of fattening the dogs on Dall sheep meat. The dogs were then in good condition and strong, worked well, and could survive the winter period that featured daily meals of frozen caribou meat while on the trail, followed by cooked food after long hunts and trapping journeys.

Caribou haunches contained little fat and, when served frozen or partially thawed, required nearly as much energy for digestion as was contained in the meal. It was common for a good team to finish the sledding season in May as lean and hard as the frozen meat that typified their rations.

The *nunamiut* used a heavy sledge better suited to the rough tundra trails than the classic "basket sled" used in many areas of greater snowfall. Two types of runners were used: steel was used during the early winter and late spring when the snow tended to be soft or sticky, and hand-hewn spruce runners were suited to midwinter conditions when the extreme cold and wind of the region had hard-packed the snow. The runners were coated with ice, built up by applying several layers of melted snow water with a piece of caribou hide each morning before a trip and whenever sledging over rocks or when rough ice broke the smooth running surface.

Women and small boys helped with the hitching of dogs in matched pairs to the center tugline. The dogs were mostly ecstatic at the first cue that a trip was in the making, probably because of their training and also because most of their lives otherwise were spent chained to a stake in their owner's dogyard. Those left behind when a team departed howled mournfully and periodically until their owner returned.

Women usually used teams of 3 or 4 dogs to haul fuel and ice to the houses from sources about 2 kilometers from the village; several women were accomplished dog handlers, but only 1 or 2 routinely "dog-teamed." Raising of pups was principally the province of the wife.

Prior to the coming of the snowmobile, trapping camps located 1 or 2 days journey from the village were usually occupied for varying periods during the winter. Trapping activities required greater effort and tended to scatter the *nunamiut* men over a considerable area. These semipermanent camps were the bases of operation for 1

the doomed

the doomsday machine

to 4 men, who entered into friendly competition in trapping and gambling. Many of the young bachelors spoke glowingly of the good times had in trapping camps and were eager to return after a short visit to the village for the holidays. This practice maintained the technology of trapping, hunting, dogteaming, and subsisting in a hard environment that was the hallmark of the inland people and which earned the respect of most other cultures.

The people were fully occupied by the requirements of their culture, which was ideally suited to their environment. Three or four stores were usually operated by older men, several people made modest amounts of money from caribou skin masks, trapping and bounties provided seasonal income, and village life in the early 1960's was relatively calm.

Having survived the winter, the people enjoyed the summer as a time of relative ease. The permafrost cellars were usually filled with caribou meat stored from the spring kill, families moved from sod houses into canvas tents, and short hunting trips were occasionally taken with dogs fitted with packs.

Women spent several days chopping and drying willows for the coming winter fuel supply, the circadian rhythms were purposely turned topsy-turvy by all-night card games, and the usual novelty of visiting scientists provided diversions.

The specter of a dwindling fuel supply was in the background of people's thoughts, however. One had only to survey the diminished willow growth in the valley to appreciate the problem; however, there were persistent stories of a nearby supply of oil shale and coal that would be used when the willows were exhausted.

Dog Days End

It was during this relatively calm period that the first snowmobile appeared, during January, 1964. It appealed to the curiosity of the Eskimos, and its performance and prestige were magnified by the initial success of the machine in hunting caribou and running traplines and by its apparent ease of maintenance. The first 2 winters proved to be a period of observation and trial of the snowmobile for a majority of Anaktuvuk Pass people, for most of them could not afford the machines.

During the summer of 1966, the first opportunities occurred for the *nunamiut* men to serve on the Bureau of Land Management forest-fire control crews, and several men served 10 days at $68/day. Many men used these funds for down payments on snowmobiles, and from then on the machines became the central theme in Anaktuvuk Pass culture. All efforts were made by the people to possess an "iron dog" at any cost, and autonomy of the families became more pronounced.

That same summer the village was given a crawler-type tractor by a governmental agency for the purpose of hauling oil shale or other fuel. The machine became a center of controversy over its uses, and this was heightened when the coal and oil shale resource was evaluated by a geologist and found to be in negligible supply and of extremely poor quality.

A proposal by governmental agencies to have Anaktuvuk Pass hunters supply caribou meat at a fair price to Operation Headstart (education of pre-school children) programs at several other villages in northern Alaska failed; the arrangements for proper inspection, handling, and transportation of the meat required unity of action by the Anaktuvuk Pass Village Council that was unattainable.

"Like the natural arctic ecosystems of which they were so integrally a part, the nunamiut *society has been sensitive to callous exploitation. The immediate and impressive impact of white-man culture . . . presaged destruction . . ."*

Similarly, a proposal was made for the village to market 1,000-2,000 caribou skin masks to be sold at the Alaska '67 Centennial Celebration to be held in Fairbanks the next summer, the proceeds to be used to purchase fuel for the village. Mask-making was at a fever pitch in the village, but the objective was to finance individual snowmobiles rather than participation in a community effort to solve the fuel problem.

During the winter of 1966-1967, 5 snowmobiles were in operation and the first friction developed between the "haves" and the "have-nots" over whether or not the noisy machines were driving the caribou higher up into the mountains where they were inaccessible to dogteamers. Several people reported that the snowmobiles could approach caribou more closely than could dogteams, probably because the caribou had not yet learned to associate the snowmobiles with danger. Furthermore, snowmobile operators could ready their machines more quickly for pursuit of caribou bands than the dogteamers could harness their dogs, and snowmobiles were faster and more sustained than dogteams in pursuit of caribou.

An Arctic Fuel Crisis

The friction within the village was undoubtedly abetted by the critical fuel situation that was by then unavoidable; the last of the willow supply was in sight and scattered sources up to 35 km away were being sought out. Alternatives were being discussed, among which was a suggestion from a Barrow minister that the *nunamiut* move to an abandoned oil exploration camp some 125 km north of Anaktuvuk Pass.

This was seized upon by several people as the logical solution and in the following months of confusion over what the village and various governmental agencies could do, the village became polarized into "movers" and "nonmovers." The division of the people was generally along band and kinship boundaries, but in a few cases pitted siblings against each other. The crisis was resolved by several government agencies that imported stoves, fuel oil, and building materials for small frame houses poorly adapted to the rigorous arctic climate.

The role of women as fuel gatherers was abolished. As the snowmobiles increased, so the role of women as custodian of the dogs decreased. The need for the hunter role for men was reduced by the decreased requirement for caribou meat for dog food, and extended hunting and trapping expeditions to distant valleys were curtailed by the increased mobility provided by the snowmobile and the introduction of weekly movies by the school teachers. Men were reluctant to spend more time outside the village than absolutely necessary, and welfare and food stamp programs encouraged increasing dependence upon governmental programs that eroded the status and roles of both males and females.

There has been an accelerating loss of situations for "achieving" and for validating roles in the *nunamiut* culture where age, sex, kinship, and performance formerly weighed heavily.

Cultural Devastation

Historically, Eskimo bands were led by a competent hunter or *umealik*. Settlement at Anaktuvuk Pass committed the people to greater acculturation and replaced the *umealik* with the Village Council, where the weak as well as the strong had a voice. As democratic as this may be and as well as it may serve the white man, it has not served the *nunamiut* cause as well as it might be presumed by the casual observer.

In their greatest test, during the bitter debate over moving the village, the time-honored concepts of band, kinship, matrilineal loyalty, and patriarchal dominance reappeared; however, their effectiveness had been diminished and compromised by amalgamation with the white man's institutions. Self-determination was lost in a welter of bureaucratic tangles, demeaning assistance in impractical areas, and the urgency of the situation.

Since that time the village has changed more rapidly, with commensurate loss of the older *nunamiut* cultural ideals. As Margaret Lantis (1967) expressed it:

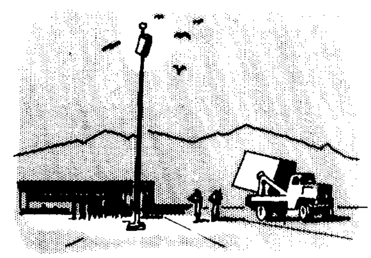
> *"Eskimos are trying just as hard today to adapt as they did 500 to 900 years ago; the difficulty is that they are adapting not to the Arctic but to a Temperate Zone way of living."*

It is not only the mere act of adapting to another culture but the rapidity with which it has been necessary that has culturally devastated the native populations.

In the case of the *nunamiut,* they have experienced in approximately 20 years the degree of cultural change that most Americans achieve in many more years. Contact agents of the white man culture had appreciable influence upon a people whose decision-making was based upon informal consultation with persons who led by popular acclaim based upon capability as a hunter and knowledge of the land. Like the natural Arctic ecosystems of which they were so integrally a part, the *nunamiut* society has been sensitive to callous exploitation. The immediate and impressive impact of white-man culture upon their carefully balanced societal systems presaged destruction in environmental areas and precipitated problems in several contexts.

It is ironic that the *nunamiut* society, so admirably adapted to its surroundings, should succumb to the culture of the white man, whom the Eskimo considered to be a child in the Arctic.

10 years ago in los alamos



Culled from the March and April, 1964, files of the Atom and the Los Alamos Monitor by Robert Y. Porton

Anniversary

Director N. E. Bradbury and several LASL staff members were among the delegates from nearly 200 academic institutions in the United States and several foreign countries who attended the recent ceremonies of the University of New Mexico's 75th anniversary. Other staffers participating were Charles Critchfield and Bob Watt.

Toppers win state crown

The Los Alamos High School Hilltoppers played with inspired perfection to win the first state basketball championship in the history of the school this weekend in Albuquerque. The Toppers and the Horsemen from St. Michael's of Santa Fe battled for the championship. The Hilltoppers won 79-65.

LAMPRE retires

LAMPRE, the world's first molten plutonium nuclear reactor, is in semi-retirement. LAMPRE helped evaluate the use of metallic plutonium fuel in the liquid rather than the solid state and was part of the Laboratory's program to develop and test fast breeder concepts. LAMPRE will now be placed on standby.

Science on display

LASL was a major exhibitor at the Southwestern Science Exposition that was held last week in El Paso, Texas. Some 2,300 high school science students from the Southwest and Old Mexico attended a series of science seminars held in conjunction with the public show, which drew more than 50,000 viewers.

Search and rescue

The Los Alamos County Civil Defense organization has been designated by the County Commissioners as the official body responsible for all search and rescue work in the county. The AEC has authorized LASL, Zia, and all other agencies under its jurisdiction to provide services, equipment, material, and manpower for missions.

Oh, say can you see

Local policemen and school officials are still wondering how a large garbage can was put on top of the tall flag pole on the high school lawn Friday night. A Zia Company crew used a "cherry picker" boom truck with a bucket on the end of a lift arm to take the refuse container down. Hundreds of delegates attending the Southwest District Key Club convention plus many local residents gathered to see the sight Saturday morning.

winners

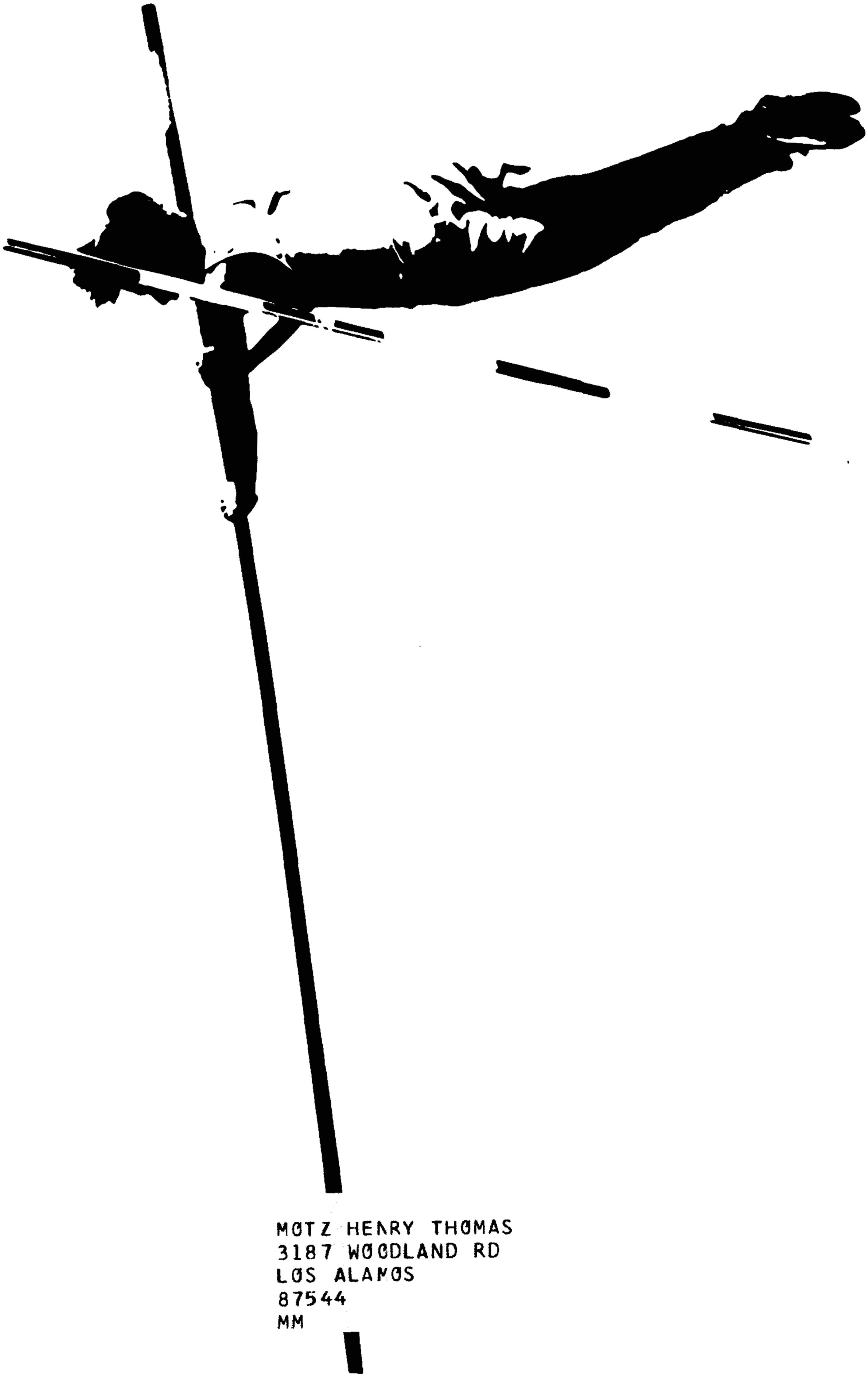
ISD-7 photographers went into the Professional Photographers of New Mexico show in Albuquerque last month and emerged with honors.

J. M. "Mitzi" Ulibarri won first place in the black and white commercial category with his "Hands," shown above. In the photo, Don Kelly, CMB-11, is preparing oxides in a glove box at DP-West. Another print by Ulibarri, "Chamber," took second place in the same category.

Bob Martin found beauty in the miniscule, employed photomacrography to produce "Zinc Flow," an extreme enlargement that won first place in color abstractions.

And Henry Ortega reduced gray tones to stark black and whites in his "Pole Vaulter," shown on the back cover, to win second place in black and white abstract photography.

All in all, a satisfying day for LASL photographers.



MOTZ HENRY THOMAS
3187 WOODLAND RD
LOS ALAMOS
87544
MM